

The  
United  
States  
of  
America



11/28/01 #14

The Commissioner of  
Patents and Trademarks

*Has received an application for a patent for a new and useful invention. The title and description of the invention are enclosed. The requirements of law have been complied with, and it has been determined that a patent on the invention shall be granted under the law.*

*Therefore, this*

United States Patent

*Grants to the person(s) having title to this patent the right to exclude others from making, using, offering for sale, or selling the invention throughout the United States of America or importing the invention into the United States of America for the term set forth below, subject to the payment of maintenance fees as provided by law.*

*If this application was filed prior to June 8, 1995, the term of this patent is the longer of seventeen years from the date of grant of this patent or twenty years from the earliest effective U.S. filing date of the application, subject to any statutory extension.*

*If this application was filed on or after June 8, 1995, the term of this patent is twenty years from the U.S. filing date, subject to any statutory extension. If the application contains a specific reference to an earlier filed application or applications under 35 U.S.C. 120, 121 or 365(c), the term of the patent is twenty years from the date on which the earliest application was filed, subject to any statutory extension.*

*Bence Lehman*

Commissioner of Patents and Trademarks

*Melvinia Gary*  
Attest



US00042985A

**United States Patent** [19]

Spear et al.

[11] Patent Number: **5,642,985**[45] Date of Patent: **Jul. 1, 1997**[54] **SWEPT TURBOMACHINERY BLADE**

[75] Inventors: **David A. Spear**, Manchester; **Bruce P. Biederman**, Meriden, both of Conn.; **John A. Orosa**, Palm Beach Gardens, Fla.

[73] Assignee: **United Technologies Corporation**, Hartford, Conn.

[21] Appl. No.: **559,965**[22] Filed: **Nov. 17, 1995**[51] Int. Cl.<sup>6</sup> ..... **F01D 5/14**[52] U.S. Cl. .... **416/238; 415/181; 416/242**[58] Field of Search ..... **415/181, 220; 416/238, 242, 243**[56] **References Cited****U.S. PATENT DOCUMENTS**

1,964,525	6/1934	McMahan	170/159
2,154,313	4/1939	McMahan	230/274
2,915,238	12/1959	Szydlowski	230/134
2,934,259	4/1960	Hausmann	415/181
2,935,246	5/1960	Roy	415/181
3,416,725	12/1968	Bohanon	230/259
3,444,817	5/1969	Caldwell	103/88
3,692,425	9/1972	Erwin	415/181
3,989,406	11/1976	Bliss	415/1
4,012,172	3/1977	Schwaar et al.	416/228
4,358,246	11/1982	Hanson et al.	416/223 R

4,408,957	10/1983	Kurzrock et al.	415/181
4,726,737	2/1988	Weingold et al.	416/223 A
4,737,077	4/1988	Vera	416/242
4,784,575	11/1988	Nelson et al.	416/226
5,112,192	5/1992	Weetman	416/201 A
5,167,489	12/1992	Wadia et al.	415/182.1

**FOREIGN PATENT DOCUMENTS**

1528965 12/1989 U.S.S.R. .... 416/242

*Primary Examiner*—Edward K. Look*Assistant Examiner*—Mark Sgantzios*Attorney, Agent, or Firm*—Kenneth C. Baran[57] **ABSTRACT**

A swept turbomachinery blade for use in a cascade of such blades is disclosed. The blade (12) has an airfoil (22) uniquely swept so that an endwall shock (64) of limited radial extent and a passage shock (66) are coincident and a working medium (48) flowing through interblade passages (50) is subjected to a single coincident shock rather than the individual shocks. In one embodiment of the invention the forwardmost extremity of the airfoil defines an inner transition point (40) located at an inner transition radius  $r_{t\text{-inner}}$ . The sweep angle of the airfoil is nondecreasing with increasing radius from the inner transition radius to an outer transition radius  $r_{t\text{-outer}}$  radially inward of the airfoil tip (26), and is nonincreasing with increasing radius between the outer transition radius and the airfoil tip.

**3 Claims, 7 Drawing Sheets**